Engineering Single Wall Carbon Nanotubes for Sub-Cellular Delivery

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To advance the usage of single wall carbon nanotubes (SWCNTs) in biology and medicine, we have utilized SWCNT visualization and cellular manipulation to control their sub-cellular localization. We have produced solutions of individualized SWCNTs using bio-inert, biological, and bioactive dispersing agents, and then determined mechanisms of cellular entry, subcellular localization and functional changes inside the cell.[1-7] We have established that SWCNTs enter cells *via* endocytosis and not membrane penetration,[2,3] and reach saturation at levels of 10^6-10^7 SWCNT per cell within minutes of treatment.[4-6] The highly purified, length-selected SWCNTs are not acutely cytotoxic but can reduce proliferation depending on the dosage levels and dispersant type.[2,7] For example, SWCNTs dispersed with bio-inert molecules induce proliferation defects with altered actin distribution, which results in giant, multinucleated cells.[2] In this talk, I will also discuss our recent effort to create new opportunities in biomedical applications including developing precision SWCNT-mediated photo-ablation; creating flexible, conducting, biocompatible cell substrates; generating targeted drug delivery vehicles with controllable sub-cellular processing; and utilizing differential uptake of SWCNTs to modulate the immune system. This work has been supported by the NSF (DMR-0645596, DMR-0619424 and CBET-0933510) and the Sloan Foundation.

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